

"pinachrome," both these being cyanine derivatives. Dr. E. König, who has investigated the comparative merits of these three sensitisers, states that if the sensitiveness conferred by ethyl red to red light is regarded as 100, "orthochrome T" gives a sensitiveness of 160 to 180, and "pinachrome" 450 to 500. But the density that the best of these sensitisers gives on development in the red and green of the spectrum is not proportional to the luminosity of these colours, therefore the exposure for these colours has to be longer than for the blue, but only about three times as long.

Theoretically perfect colour screens or filters are therefore useless, because a perfect plate, so far as the interpretation of colour is concerned, has not yet been produced. The colour screens and plates must be tested together, and for this purpose it is necessary to have recourse to the spectroscope, making photographs, of course, under the various conditions. But

that should be obtained when this is photographed, using the given plate and each of the three colour screens in turn. To facilitate the use of the chart, an extra copy is provided in a pocket on the cover of the book. A grey scale of different shades, made on platinum printing paper, is exposed and developed with the colour chart, and the three prints should show this grey scale alike, when the differences due to the colour screens should be as shown in the three prints supplied.

CHAPMAN JONES.

(To be continued.)

REFLEXIONS IN WATER.¹

THERE are few studies more fascinating than that of the reflexions formed naturally in the sea, and in rivers and lakes. In the first place, this study is naturally pursued in the open air; further,



FIG. 1.—Old Harbour Side, Scarborough. From "Light and Water."

spectroscopic results are so liable to deceive observers who are not thoroughly accustomed to such work that less discriminative methods of testing are generally preferred. The colour sensitometric methods that Sir William Abney has done so much to perfect are often employed for this purpose. A series of small pieces of suitably coloured material are arranged in such a manner that when the plate is exposed through its screen and this sensitometer a definite and easily recognisable result will be obtained if the plate and screen are mutually correct. Or the colours may be arranged on a rotating disc concentrically with a grey produced by the mixture of definite proportions of black and white, so that the colour and the grey will give an equal density in a photograph of it taken in the camera through the screen on the plate. Colonel Hübl, in the volume above referred to, gives a colour chart that consists of small patches of nine pigments, with the results

the effects observed are often of surprising beauty; and lastly, most, if not all, of the phenomena observed can be explained in accordance with a few simple principles, so that it is possible for almost anyone possessing a trained faculty of observation to add to our knowledge in this direction. In writing a book on reflexions in water, Sir Montagu Pollock has entered an almost untrodden region within the borders of both art and science; with the exception of some passages in the works of Mr. Ruskin, it would be difficult to refer to any other work dealing with the same subject. It is no small accomplishment to produce a book in which so many intricate effects are traced to their causes, using language

¹ "Light and Water: a Study of Reflexion and Colour in River, Lake, and Sea." By Sir Montagu Pollock, Bart. Pp. xii+115; with 39 plates and 28 explanatory figures. (London: George Bell and Sons, 1903.) Price 10s. 6d. net.

of the simplest, and yet sacrificing nothing in the way of accuracy and clearness; and, although the book was written to aid artists in their study of nature, it will none the less be welcomed by men of science and those amongst the general public who attach importance to accurate observation.

There are some artists who make no secret of their disdain for scientific methods as an aid to their work; but even these, on reading Sir Montagu Pollock's book, will be forced to admit their indebtedness. Some sort of scientific method is indispensable for accurate observation of reflexions in water. Even reflexions in still water differ from what would be expected by an untrained observer; the reflected image is indeed generally a counterpart of the object, but it not uncommonly presents an entirely different aspect. Many striking instances of this are discussed and explained in the first chapter; one of the most remarkable is afforded by the reflexion of a rainbow in a lake, which is really the image of a bow quite distinct from the one seen directly. When we come to the study of reflexions in rippled water, further complications arise; in the second chapter, the reader is led on from the most simple and elementary facts to appreciate and understand complicated effects such as are reproduced in the accompanying illustration (Fig. 1). In such cases some amount of scientific training is absolutely necessary to one who would give a faithful pictorial representation of nature; for the appearance presented changes every instant, and without the aid of some sort of clue one can scarcely avoid obtaining inharmonious effects. But even in still water, where there is no incessant change to distract the attention, there are yet many opportunities for the artist to go wrong; without a very accurate knowledge of fundamental principles, it would be impossible, for instance, to deduce the nature of the reflexions shown in Fig. 2 from the actual appearance of the objects reflected. Notice, for instance, that while the reflected image of the spire of the distant church is seen, the body of the church and the dark hill behind it are not present in the reflexion; there is even no image to be seen of the shore between the church and the water.

The third and fourth chapters are devoted to a study of the colours in still and rippled water. This part of the subject is exceedingly complicated, and it is difficult to make any general statement which will help us to predict the exact colours to be seen under given conditions. The observed colour of the water is due, partly to light reflected from the surface of the water; partly to light scattered by minute particles floating on the surface; partly to the

inherent colour of the water, modified, maybe, by the presence of fine suspended particles; partly to the colour of the stones, sand, or mud at the bottom of the water; and, lastly, the whole effect is complicated by "contrast," which may modify greatly the various colours observed. For instance, standing on one of the cliffs of Sark, and looking out over the sea, the latter often appears of a vivid green, dappled here and there with patches of intense purple. Careful observation shows that the purple patches mark the

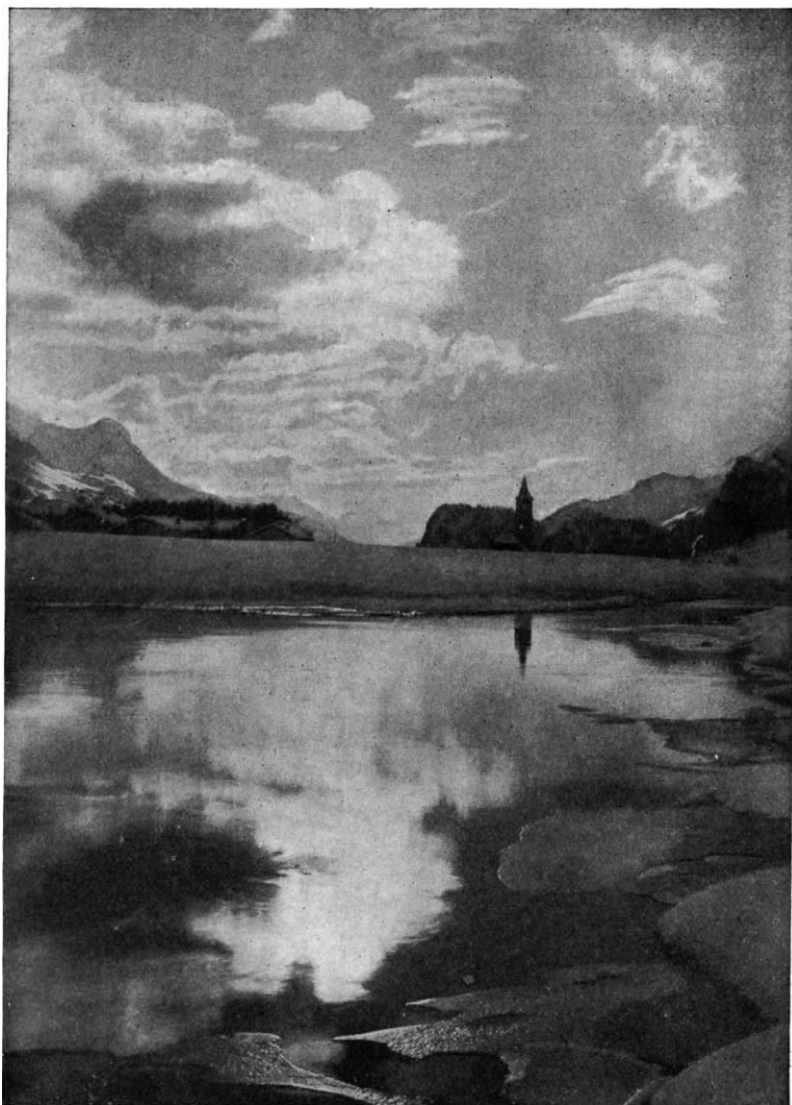


FIG. 2.—Sils Basaglia, Upper Engadine. From "Light and Water."

sites of submerged beds of sea-weed; but the weed is not itself purple, but of a dark olive-green colour, so that the colour of the patches is not easily explained. The most probable explanation appears to be as follows:—The sea-water is itself blue, *i.e.*, it is relatively opaque to red and partly opaque to yellow light. Yellow light is most copiously reflected from the sandy bottom of the sea, so that, on the whole, the greater part of the light reflected from the bottom of the sea which reaches our eyes is green. The beds of sea-weed merely act as general absorbers, and would give rise to dark patches were

it not for the effect of contrast; it is well known that a grey object lying on a vividly green ground appears to be of a reddish or purplish hue. It may here be remarked that this phenomenon yet awaits explanation; it was at one time thought that the eye insensibly travelled over the green expanse, the green colour sensation became fatigued, and faint white light afterwards provoked the complementary sensation. It has been found, however, that the same colour phenomena are observed when the illumination is instantaneous, so that this theory falls to the ground.

Finally, it may be stated that Sir Montagu Pollock's book is throughout of absorbing interest; the excellence of the illustrations can be inferred from an inspection of those used to illustrate this short notice, and the printing is everything that could be desired.

EDWIN EDSER.

NOTES.

WE understand that the second International Wireless Telegraph Conference, which was to have been held in Berlin on October 6, has been postponed until next spring. It will be remembered that the Wireless Telegraph Act which was passed at the end of last session was rushed through the House partly that the Government representatives might have a better basis for making agreements at this conference. It is stated that a considerable number of applications for licences under this Act have been received by the Postmaster-General. Some of these applications come from the submarine cable companies.

THE funeral of Prof. Niels Finsen at Copenhagen on September 29 was attended in person by King Christian, King George of Greece, Queen Alexandra, and all the other Royalties now in Copenhagen, as well as by the Danish Ministers of State, members of the Diplomatic Corps, the president of the Danish Parliament, the Burgomasters of Copenhagen and the chief provincial towns, and numerous representatives of foreign scientific institutions, universities, and societies. King Edward was represented by the British Minister, Sir W. E. Goschen. A number of Danish medical men have issued an appeal for the erection of a monument to Prof. Finsen by voluntary contributions.

A NEW association, the Institute of Hygiene, has been formed having for its object the dissemination of knowledge on the subject of personal and domestic hygiene. It aims to be self-supporting, and in order to accomplish this has organised a permanent exhibition of hygienic products and appliances, e.g. foods, clothing, filters, stoves, &c., open free to the general public, and a special section devoted to drugs and medical and surgical appliances to which medical men alone are admitted. The revenue gained from the rents paid by exhibitors will be devoted to educational work, which will take the form of local lectures, with examinations and certificates. The exhibition, which was formally opened by Sir Joseph Fayrer on September 30, is housed at 34 Devonshire Street, W.

A VISIT by a party of French physicians and surgeons is about to be paid to London. The party is to arrive on October 10, and will comprise some 150 gentlemen. A committee, of which Sir William Broadbent is president and Sir Thomas Barlow treasurer, has been organised to make arrangements for their reception and entertainment, Dr. Dawson Williams and Dr. Jobson Horne being the honorary secretaries. They will be entertained at a banquet at the Hotel Cecil on October 12.

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PROF. KOCH has retired from the post of director of the Institute for Infectious Diseases at Berlin owing to the increasing demands which other bacteriological work make upon his time and energies. The Berlin correspondent of the *Times* states that in the course of the winter Prof. Koch will proceed to German East Africa in order to continue those studies of tropical and other diseases which he had not completed during his recent visit to Rhodesia. In particular he will continue to investigate the part played by ticks in conveying the infection of various cattle diseases.

A CONFERENCE on agricultural education will be held in the Shire Hall, Gloucester, on Saturday, October 15, under the presidency of Sir John Dorington, M.P. At the morning session Lord Onslow will deliver an address, and the other speakers will include Sir W. Hart Dyke, Prof. T. H. Middleton, and Lord Monteaigle. At the afternoon session Sir T. Dyke-Acland, Sir John Cockburn, Mr. A. D. Hall, and others will address the conference.

THE deaths are announced of Prof. E. von Martens, vice-director of the Berlin Zoological Museum, and Dr. P. van der Vliet, formerly professor of physics at the University of St. Petersburg.

THE Physico-Mathematical Society of Kazan has awarded the Lobatchewsky prize to Prof. D. Hilbert, of Göttingen, for his book on "Die Grundlagen der Geometrie" and other researches. The Lobatchewsky gold medal has been conferred on Prof. Poincaré, and Profs. Mansion, Laisant, and Peano have been elected honorary members of the society.

THE twenty-fifth annual "Fungus Foray" of the Essex Field Club will be held on Saturday, October 15, at High Beach, Epping Forest. The referees will be Dr. M. C. Cooke and Mr. George Massee, of the Kew Herbarium. Mr. Massee will read a paper on some diseases of trees. Any botanists wishing to attend should communicate with the secretary, Buckhurst Hill, Essex.

PROF. FEHR, of Geneva, editor of *L'Enseignement mathématique*, is circulating among mathematicians an inquiry form containing a number of questions relating to their manner of working. These questions refer to such points as when and where the mathematician answering them acquired his taste for mathematics, whether his researches are suggested by the study of mathematical literature or the ideas come to him spontaneously, whether he publishes his ideas immediately or leaves them for a time, whether he observes regular rules in his living, whether he finds the morning or evening best for work, and so forth. The answers are to be analysed by Prof. Th. Flournoy and Dr. E. Claparède, both experienced psychologists.

THE system of "normal piling" which forms the basis of Prof. Osborne Reynolds's "Theory of the Universe," is discussed by the late Prof. J. D. Everett in the *Philosophical Magazine* for July. In the review of Prof. Reynolds's work, which appeared in *NATURE*, attention was directed to the fact that the arrangement of spheres consistent with minimum volume is not unique. Prof. Everett's paper states that every system of maximum compactness consists of parallel tiers in triangular arrangement, but each tier can be fitted over the one below in two ways. When two tiers have been placed the piling will be normal if the spheres of the third tier are *not* vertically above those of the first; but another arrangement, giving rise to what Prof. Everett called *antinormal* piling, may be obtained by placing the third tier in the spaces above the first.